

corresponding to ones of the nozzles; and

adhering the membrane to a heat driving part to form second chambers separated from corresponding (first chambers) by the membrane, and to form fluid jetting apparatuses to form an undivided piece with each fluid jetting apparatus having one of the nozzles.

REMARKS

INTRODUCTION:

In accordance with the foregoing, claims 1, 2, 13, 17, 23, 27, 31, 44, and 45 have been amended. No new matter is being presented, and approval and entry are respectfully requested.

Claims 1, 2, 13-17, 19, 21, 23, 24, 27, 30, 31, and 38, 40, 42, 44, 45, and 47 are pending and under consideration. Reconsideration is requested.

CONSIDERATION OF INFORMATION DISCLOSURE STATEMENT FILED JANUARY 15,

2002:

On January 15, 2002, the applicants filed an Information Disclosure Statement under 37 C.F.R. 1.97(b) since the outstanding Office Action, while mailed on January 10, 2002, had not been received prior to the Information Disclosure Statement being sent to the U.S. Patent and Trademark Office. However, since the applicants are able to make the statement under 37 C.F.R. §1.97(e) as indicated in item 5 of the Information Disclosure Statement, it is respectfully requested that the Information Disclosure Statement be considered pursuant to 37 C.F.R. § 1.97(c) since the Information Disclosure Statement was filed after the mailing of the Office Action and the statement under 37 C.F.R. §1.97(e) is applicable.

OBJECTION TO THE TITLE:

On page 2 of the Office Action, the Examiner objects to the title and suggests a new title: "A Process of Manufacturing Fluid Jetting Apparatuses." However, as of the Amendment filed April 4, 2001, the title has been amended to "A Process of Manufacturing Fluid Jetting Apparatuses" as indicated above. As such, it is respectfully requested that the Examiner reconsider the objection to the title.

OBJECTION TO THE CLAIMS:

On page 3 of the Office Action, the Examiner objects to the use of the term "type" in relation to the phrase "wafer type" as recited in claims 31 and 44. The term type has been

removed from the claims. As such, it is respectfully requested that the Examiner withdraw the objection to claims 31 and 44.

REJECTION UNDER 35 U.S.C. §112:

Rejection under 35 U.S.C. §112, first paragraph

On page 3 of the Office Action, the Examiner rejects claims 1, 2, 17, 19, 23, 27, 30, 31, 38, 40, 42, 44, 45, and 47 under 35 U.S.C. §112, first paragraph, as not being described in the specification in such a way to convey that the applicant had possession of the invention in the application as filed. Specifically, the Examiner states that the term “continuous” as recited in claims 1, 17, 27, 31, and 45 is unsupported in the specification, as filed.

As such, the claims have been amended to replace the term “continuous” with “undivided.” The specification, as filed, provides support for the term “undivided” on page 9, lines 17-19, which discusses the resulting wafer as “an integrity of the plurality of fluid jetting apparatuses.” In this context, one of ordinary skill in the art would understand at the time of filing that “integrity” indicates the wafer is undivided. See, e.g., Webster’s Ninth New College Dictionary, p. 628 (Merriam-Webster Inc.) (1986) (“integrity” means a “quality or state of being complete or undivided.”)

Further, in the embodiment discussed on page 9, lines 8-11, of the specification, the wafer unit shown in FIG. 3D is described as being formed as a wafer unit that is cut into sections to be supplied to the subsequent process of manufacturing the print head. The embodiment shown in FIG. 3D and shown in cross section in FIG. 8B discloses the individual printing apparatuses prior to being cut (i.e., divided). Thus, an embodiment of the invention as shown in FIGs. 3D and 8B disclose an undivided wafer.

As such, it is respectfully submitted that the specification provides sufficient description for the term “undivided” as to show possession of the subject matter as the time of filing. Therefore, it is respectfully submitted that claims 1, 2, 17, 19, 23, 27, 30, 31, 38, 40, 42, 44, 45, and 47 are compliant with 35 U.S.C. §112, first paragraph.

Rejection under 35 U.S.C. §112, second paragraph

On page 4 of the Office Action, the Examiner rejects claims 1, 2, 13-17, 19, 23, 27, 30, 31, 38, 40, 42, 44, 45, and 47 under 35 U.S.C. §112, second paragraph, as being indefinite with regard to the term “continuous.” Specifically, the Examiner states that the claims are unclear as to what degree the shape of the nozzle part, the membrane, and the heat driving part together form a continuous piece or a continuous wafer.

As noted above, the term "continuous" has been replaced with the term "undivided." As such, the recited shape of the nozzle part, the membrane, and the heat driving part is as an undivided wafer or unit. The undivided wafer or unit is of fluid jetting apparatuses such that the shape is defined by the still-connected fluid jetting apparatuses. As such, it is respectfully submitted that claims 1, 2, 13-17, 19, 23, 27, 30, 31, 38, 40, 42, 44, 45, and 47 are deemed compliant with 35 U.S.C. §112, second paragraph.

Lastly, the Examiner rejected claims 1, 13, 23, and 27 as containing terms lacking antecedent basis and/or being unclear. While it is believed that the claims were previously compliant with the requirements of 35 U.S.C. §112, claims 1, 13, 23, and 27 have been amended as required and it is respectfully requested that the Examiner reconsider the rejection of these claims for lacking antecedent basis and/or being unclear.

REJECTION UNDER 35 U.S.C. §102:

Rejection of claims 31, 44, 45, and 47

On page 5 of the Office Action, the Examiner rejects claims 31, 44, 45, and 47 under 35 U.S.C. §102(b) in view of Campanelli (U.S. Patent No. 4,878,992). The rejection is traversed and reconsideration is respectfully requested.

By way of review, Campanelli discloses forming ink jet print heads by adhering channel plates 31 to a heating element substrate 36. A polymer layer 58 is formed between each of the channel plates 31 and the heating element substrate 36. The channel plates 31 each have a nozzle 27, a manifold 22, and a channel 21. (Col. 5, lines 26-30; FIGs. 2 and 3) As such, Campanelli discloses forming ink jet print heads by adhering channel plates 31 to a corresponding polymer layer 58 on top of a heating element substrate 36.

However, as shown in FIGs. 2 and 3, there is no disclosure that a space exists between the heating element substrate 36 and the polymer layer 58.

In contrast, claim 31 recites "adhering a nozzle part to a membrane to form first chambers," and "adhering the membrane to a heat driving part to form second chambers separated from corresponding first chambers by the membrane, and to form the fluid jetting apparatuses." As such, claim 31 recites forming chambers between the heat driving part and the member. Therefore, it is respectfully submitted that Campanelli does not disclose the invention of claim 31, and similarly does not disclose the invention of claim 45.

Claims 44 and 47 are deemed patentable due at least to their depending from corresponding claims 31 and 45.

REJECTION UNDER 35 U.S.C. §103:**Rejection of claims 1, 2, and 38**

On pages 6-7 of the Office Action, the Examiner rejects claims 1, 2, and 38 under 35 U.S.C. §103 in view of Campanelli, Hawkins et al. (U.S. Patent No. Re: 32,572) (hereafter "Hawkins '572"), and Hawkins et al. (U.S. Patent No. 5,006,202) (hereafter "Hawkins '202"). The rejection is respectfully traversed and reconsideration is requested.

On page 6 of the Office Action, the Examiner asserts that the polymer layer 58 of Campanelli corresponds to the recited membrane of claim 1. As similarly noted above, while Campanelli discloses forming ink jet print heads by adhering channel plates 31 to a corresponding polymer layer 58 on top of a heating element substrate 36, as shown in FIGs. 2 and 3, there is no disclosure that a space exists between the heating element substrate 36 and the polymer layer 58.

In contrast, claim 1 recites "adhering a membrane to the formed nozzle part and a heat driving part." The heat driving part includes "fluid chambers for corresponding fluid jetting apparatuses," and "the membrane separates the fluid chambers of the heating driving part from the nozzle part." Since Hawkins '572 and Hawkins '202 are not relied upon and do not disclose such a feature, it is respectfully submitted that the combination of Campanelli, Hawkins '572, and Hawkins '202 does not disclose or suggest the invention recited in claim 1.

Claims 2 and 38 are deemed patentable due at least to their depending from claim 1.

Rejection of claims 17 and 19

On pages 7-8 of the Office Action, the Examiner rejects claims 17 and 19 under 35 U.S.C. §103 in view of Leban (U.S. Patent No. 5,299,785) and Baise et al. (U.S. Patent No. 4,371,565). The rejection is respectfully traversed and reconsideration is requested.

As a point of clarification, it is noted that Leban is U.S. Patent No. 5,229,785 instead of U.S. Patent No. 5,999,785. It is assumed that the Examiner is referring to Leban (U.S. Patent No. 5,229,785) based upon prior Office Actions. If this assumption is in error, the rejection is traversed since U.S. Patent No. 5,999,785 does not include the referenced FIGs. and does not disclose the manufacture of ink jet print heads.

On page 7 of the Office Action, the Examiner asserts that the photo resist layer 12 of Leban corresponds to the membrane recited in claim 17. By way of review, as shown in FIG. 1G, the photo resist layer 12 contacts plastic material 14, into which orifice opening 20 is formed. However, the photo resist layer 12 does not contact the thin film substrate 34 or the heater resistor element 36. Thus, Leban does not disclose the photo resist layer 12 contacting the

plastic material 14 and the thin film substrate 34.

In contrast, claim 17 recites “adhering the nozzle part with the silicon wafer to a membrane.” Claim 17 further recites “adhering the membrane with the adhered nozzle part to a heat driving part.” As such, the membrane is recited as being attached to the nozzle part and the heat driving part. Since Baise et al. is not relied upon and does not disclose such a feature, it is respectfully submitted that the combination of Leban and Baise et al. does not disclose the invention recited in claim 17.

Claim 17 has been amended to clarify an existing feature and has not been amended to narrow the scope of the claim.

Claim 19 is deemed patentable due at least to its depending from claim 17.

Rejection of claim 23

On pages 8-9 of the Office Action, the Examiner rejects claim 23 under 35 U.S.C. §103 in view of Leban, Baise et al., and Tsung Pan (U.S. Patent No. 4,894,664). The rejection is respectfully traversed and reconsideration is requested.

As an initial matter, Tsung Pan is not relied upon and does not disclose the recited membrane of claim 17. As such, the combination of Leban, Baise et al., and Tsung Pan does not disclose or suggest the invention recited in claim 23 due at least to the combination not disclosing the invention recited in claim 17, from which claim 23 depends.

Further, on page 9, the Examiner asserts that the beams 12 and the resistive layers 15 of Tsung Pan correspond to the recited driving fluid barriers and the heat driving elements of claim 23. As shown in FIG. 3, Tsung Pan discloses the resistive layer 15 being on top of the beams 12. Further, the beams 12 define gaps connecting the well 11 and nozzle area 17. As such, the beams 12 define gaps where the resistive layer 15 are on the beams 12, which are on the side of the gaps.

In contrast, claim 23 recites “forming driving fluid chambers between corresponding pairs of the driving fluid barriers with the electrodes and the heat elements forming bottom sides of the corresponding driving fluid chambers.” Since Leban and Baise et al. are not relied upon and do not disclose such a feature, it is respectfully submitted that the combination of Leban, Baise et al., and Tsung Pan does not disclose or suggest the invention recited in claim 23.

Rejection of claim 40

On pages 9-10 of the Office Action, the Examiner rejects claim 40 under 35 U.S.C. §103 in view of Leban, Tsung Pan, and Campanelli. The rejection is respectfully traversed and reconsideration is requested.

On page 10 of the Office Action, the Examiner relies upon Campanelli as disclosing separating the fluid jetting apparatuses using a dicing blade. Even assuming arguendo that the Examiner is correct, it is respectfully submitted that Campanelli does not disclose “adhering the nozzle part with the silicon wafer to a membrane” and “adhering the membrane with the adhered nozzle part to a heat driving part” as recited in claim 17, from which claim 40 depends. As such, it is respectfully submitted that the combination of Leban, Tsung Pan, and Campanelli and does not disclose or suggest the invention recited in claim 40 due at least to the combination not disclosing the invention recited in claim 17, from which claim 40 depends.

Rejection of claims 27, 30, and 42

On pages 10-11 of the Office Action, the Examiner rejects claims 27, 30, and 42 under 35 U.S.C. §103 in view of Campanelli, Hawkins '572, Baise et al., and Torpey et al. (U.S. Patent No. 4,638,337). The rejection is respectfully traversed and reconsideration is requested.

On page 10 of the Office Action, the Examiner asserts that the polymer layer 58 of Campanelli corresponds to the recited membrane of claim 27. Further, on page 11 of the Office Action, the Examiner relies upon Baise et al. as disclosing the formation of the membrane on a second substrate as recited in claim 27. As a motivation to form the membrane on the second substrate using the method of Baise et al., the Examiner asserts that Baise et al. teaches spin coating an organic layer onto a substrate so as to increase the adhesion between coated layers.

By way of review, Baise et al. discloses a method of adhering an organic resin and a substrate. As an example, Baise et al. discloses the need to add passivation layers onto semiconductors. The improvement asserted by Baise et al. is in attaching the resin to the substrate. (Col. 1, lines 7-10, 58-62 of Baise et al.) There is no disclosure that, once coated, the organic resin retains these adhesion properties for use with other coatings onto which the organic resin has not been coated.

Further, Campanelli discloses forming a polymer layer 58 between the channel plates 31 and the heating element substrate 36. (Col. 5, lines 26-30; FIGs. 2 and 3 of Campanelli). The polymer layer 58 appears to correspond to the SiO₂ passivation layer formed on the heating elements 34 and electrodes 33 as disclosed in Hawkins '572. (Col. 7, lines 50-59). According to Hawkins '572, which describes the manufacture of the polymer layer in greater detail, the SiO₂ passivation layer is formed directly on the heating elements 34 and electrodes 33. Assuming the combination were proper, therefore, Baise et al., Campanelli, and Hawkins '572 appear to disclose forming a passivation layer on the heating elements 34 and electrodes 33, where the process of Baise et al. improves the adhesion of the passivation layer to the heating elements 34 and electrodes 33. There is no disclosure that another substrate is used, or that the use of the

additional substrate would improve the adhesion of the passivation layer to other substrates on which the layer is not deposited using the method of Baise et al.

In contrast, claim 27 recites "forming a nozzle part on a first substrate," "forming a membrane on a second substrate," and "forming a heat driving part by forming electrodes and heat elements on a third substrate." Thus claim 27 recites forming the membrane on a second substrate, which is different from the first substrate of the nozzle part and the third substrate of the heat driving part. Therefore, since Torpey et al. is not relied upon and does not disclose such a feature, it is respectfully submitted that the combination of Campanelli, Hawkins '572, Baise et al., and Torpey et al. does not disclose or suggest the invention recited in claim 27.

Claims 30 and 42 are deemed patentable due at least to their depending from claim 27.

In order to clarify the method of claim 27 without narrowing its scope, claim 27 has been amended to recite removing the first, second, and third substrates from the corresponding formed nozzle part, membrane, and heat driving part. It is respectfully submitted that one of ordinary skill in the art would have understood this operation to have been performed based upon the totality of the claimed method.

STATUS OF CLAIMS NOT REJECTED IN OFFICE ACTION:

On page 12 of the Office Action, the Examiner states that claims 13-16 would be allowable if written to overcome the rejection under 35 U.S.C. §112, and that claims 21, and 24 are allowed.

ATTACHMENT:

Attached hereto is a "Version With Markings to Show Changes Made," comprising a marked-up version of changes made to the Claims by the current amendment.

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited and possibly concluded by the Examiner contacting the undersigned attorney for a telephone interview to discuss any such remaining issues.

If there are any additional fees associated with the filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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VERSION WITH MARKING TO SHOW CHANGES MADE

IN THE CLAIMS:

Please **AMEND** claims 1, 2, 13, 17, 23, 27, 31, 44, and 45, as follows. The remaining claims are reprinted, as a convenience to the Examiner, as they presently stand before the U.S. Patent and Trademark Office.

1. (TWICE AMENDED) A process of manufacturing a plurality of fluid jetting apparatuses at once, comprising:

- forming a nozzle part by a spinning process; and
- adhering a membrane to the formed nozzle part and a heat driving part to position the heat driving part, the membrane and the nozzle part in order to form the fluid jetting apparatuses in [the] a shape of an undivided [continuous] wafer to be split into separate fluid jetting apparatuses,
- wherein
- the heat driving part includes fluid chambers for corresponding fluid jetting apparatuses, and
- the membrane separates the fluid chambers of the heating driving part from the nozzle part.

2. (ONCE AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 1, further comprising:

- forming electrodes and heating elements on a first substrate of wafer;
- forming driving fluid barriers on the electrodes and the heating elements; and
- forming [driving] the fluid chambers in the driving fluid barriers, to form the heat driving part.

3-12 (PREVIOUSLY CANCELED)

13. (ONCE AMENDED) A process of manufacturing a plurality of fluid jetting apparatuses, comprising:

- forming electrodes and heat elements on a first substrate of silicon wafer, forming driving fluid barriers on the electrodes and heat elements, and driving fluid chambers in the driving fluid barriers, to form a heat driving part;

forming a polyimide coating layer on a second substrate of silicon wafer, forming an adhesive polyimide coating layer on the polyimide coating layer, attaching a first reinforcing ring to the adhesive polyimide coating layer, and separating the polyimide coating layer from the second substrate after attaching the first reinforcing ring on the adhesive polyimide coating layer, to form a membrane;

attaching a second reinforcing ring beneath a third substrate of silicon wafer by [the] a spinning process, forming a nozzle plate on an opposite side of the third substrate from that of the second reinforcing ring, forming jetting fluid barriers on the nozzle plate, forming jetting fluid chambers in the jetting fluid barriers, and forming nozzles in the nozzle part;

adhering the polyimide coating layer of the membrane to the jetting fluid barriers, and separating the second reinforcing ring and the third substrate of silicon wafer, from the nozzle plate; and

adhering the adhesive polyimide coating layer of the membrane to the driving fluid barriers of the heat driving part.

14. (NOT AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 13, wherein the forming of the polyimide coating layer on the second substrate and the forming of the adhesive polyimide coating layer on the polyimide coating layer are accomplished by the spinning process.

15. (NOT AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 13, wherein the forming of the nozzles in the nozzle plate is accomplished by using a laser beam from a treating apparatus.

16. (NOT AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 13, wherein the forming of the nozzles in the nozzle plate is accomplished by a process of reactive ion etching.

17. (THREE TIMES AMENDED) A process of manufacturing a plurality of fluid jetting apparatuses at once, comprising:

forming a nozzle part on a silicon wafer by a spinning process;

adhering the nozzle part with the silicon wafer to a membrane;

removing the silicon wafer from the nozzle part; and

adhering the membrane with the adhered nozzle part to a heat driving part to form the

fluid jetting apparatuses as an [continuous piece to be split into separate fluid jetting apparatuses] undivided unit.

18. (PREVIOUSLY CANCELED)

19. (NOT AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 17, wherein the forming of the nozzle part comprises:

- forming a nozzle plate on a first substrate by the spinning process;
- forming jetting fluid barriers on the nozzle plate by the spinning process;
- forming a first reinforcing element on the first substrate;
- forming jetting fluid chambers in the jetting fluid barriers; and
- forming nozzles in the nozzle plate.

20. (PREVIOUSLY CANCELED)

21. (AS ONCE AMENDED) A process of manufacturing a plurality of fluid jetting apparatuses at once, comprising:

- forming a nozzle part on silicon wafer by a spinning process, the forming the nozzle part comprising:

- forming jetting fluid barriers on the nozzle plate by the spinning process;
- forming a first reinforcing element on the first substrate;
- forming jetting fluid chambers in the jetting fluid barriers; and
- forming nozzles in the nozzle plate;

- forming a membrane, the forming the membrane comprising

- forming a polyimide coating layer on a second substrate of silicon wafer;
- forming an adhesive polyimide coating layer on the polyimide coating layer;
- forming a second reinforcing element on the adhesive polyimide coating layer;

and

- separating the polyimide coating layer from the second substrate after forming the second reinforcing element on the adhesive polyimide coating layer;

- adhering the nozzle part with the silicon wafer to the membrane;
- removing the silicon wafer from the nozzle part; and
- adhering the membrane to a heat driving part.

22. (PREVIOUSLY CANCELED)

23. (ONCE AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 17, further comprising forming the heat driving part, the forming the heat driving part comprising:

forming electrodes and heat elements on a substrate of another silicon wafer;
forming driving fluid barriers on the electrodes and the heat [driving] elements; and
forming driving fluid chambers [in] between corresponding pairs of the driving fluid barriers with the electrodes and the heat elements forming bottom sides of the corresponding driving fluid chambers.

24. (NOT AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 21,

forming the heat driving part, comprising

forming electrodes and heat elements on a third substrate of silicon wafer;
forming driving fluid barriers on the electrodes and the heat driving elements; and
forming driving fluid chambers in the driving fluid barriers.

25-26. (PREVIOUSLY CANCELED)

27. (THREE TIMES AMENDED) A process of manufacturing a plurality of fluid jetting apparatuses, comprising:

forming a nozzle part on a first substrate of silicon wafer by a first spinning process;
forming a membrane on a second substrate of silicon wafer by [the] a second spinning process;
forming a heat driving part by forming electrodes and heat elements on a third substrate of silicon wafer;
removing first, second, and third substrates from the corresponding formed nozzle part, membrane, and heat driving part; and
adhering the nozzle part to the membrane, and the membrane to the heat driving part to form the fluid jetting apparatuses as an undivided [continuous] piece to be separated into individual fluid jetting apparatuses.

28-29. (PREVIOUSLY CANCELED)

30. (AS ONCE AMENDED) The process of manufacturing a plurality of fluid jetting apparatuses as claimed in claim 27, wherein:

the forming of the electrodes on the third substrate is performed by a lithography process or a wet etching process; and

the forming of the heat elements on the third substrate is performed by the lithography process, the spinning process or a lift-off process.

31. (TWICE AMENDED) A process of manufacturing a plurality of fluid jetting apparatuses, comprising:

adhering a nozzle part to a membrane [as a wafer type] to form first chambers, each corresponding to ones of the plurality of fluid jetting apparatuses; and

adhering the membrane to a heat driving part to form second chambers separated from corresponding first chambers by the membrane, and to form the fluid jetting apparatuses as an [continuous] undivided wafer to be separated into individual fluid jetting apparatuses.

32-37 (PREVIOUSLY CANCELED).

38. (NOT AMENDED) The process of claim 1, further comprising splitting the fluid jetting apparatus in the form of the wafer into separate fluid jetting apparatuses.

39. (PREVIOUSLY CANCELED)

40. (NOT AMENDED) The process of claim 17, further comprising splitting the adhered nozzle part, membrane, and heat driving part into separate fluid jetting apparatuses.

41 (PREVIOUSLY CANCELED)

42. (NOT AMENDED) The process of claim 27, further comprising splitting the adhered nozzle part, membrane, and heat driving part into separate fluid jetting apparatuses.

43. (PREVIOUSLY CANCELED)

44. (ONCE AMENDED) The process of claim 31, further comprising splitting the

undivided wafer [type] of fluid jetting apparatus into separate fluid jetting apparatuses.

45. (TWICE AMENDED) A process of forming fluid jetting apparatuses, comprising:
adhering a nozzle part having nozzles to a membrane to form first chambers, each
corresponding to ones of the nozzles; and

adhering the membrane to a heat driving part to form second chambers separated from
corresponding first chambers by the membrane, and to form fluid jetting apparatuses to form an
undivided [continuous] piece with each fluid jetting apparatus having one of the nozzles.

46. (PREVIOUSLY CANCELED)

47. (NOT AMENDED) The process of claim 45, further comprising splitting the
adhered membrane, nozzle part, and heat driving part into separate fluid jetting apparatuses.